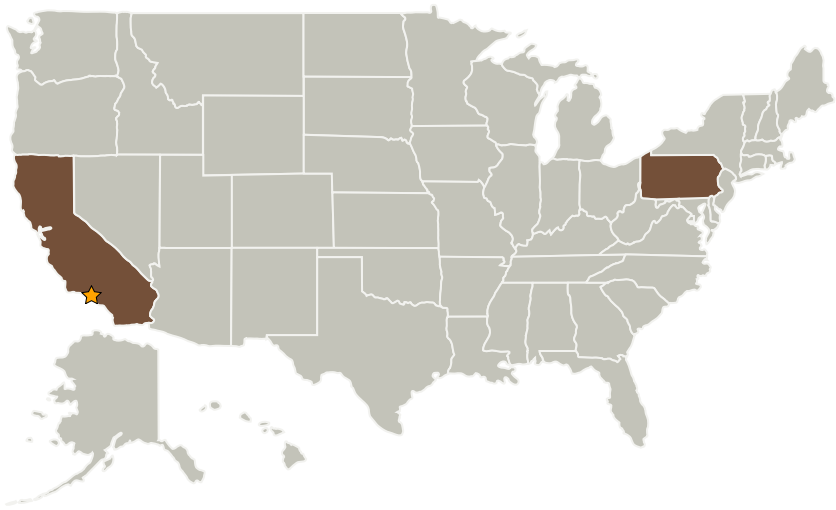
Cryogenic Piezo Actuators for Lightweight, Large Aperture, Deployable Membrane Mirrors, Phase I

Completed Technology Project (2007 - 2007)

Project Introduction

Single crystal piezoelectric actuators are proposed to enable large stroke, high precision, shape control for cryogenic lightweight deployable membrane mirror structures for future NASA Science and communications applications. Piezoelectric properties of PMN-PT single crystal at a temperature of 4 K will be investigated. Compact piezo linear motor utilizing PMN-PT single crystal driver will be assembled and characterized at temperatures of 4K-300K. Specific goals for cryomotor are: maximum stroke >100 mm, maximum driving force ~10 N, response time ~ ms, positioning resolution ~50 nm, operating temperature of 4K-300 K, total mass <50 g, and power consumption <1 W. The deployment structure design and the stroke, force required for membrane mirror deployment will be identified in the phase I, and a 25 mm aperture membrane mirror deployment concept demonstration will be conducted in Phase I. At the conclusion of the Phase I program the feasibility of single crystal cryomotor for deployable membrane mirror will have been demonstrated. In Phase II, optimized single crystal piezoelectric actuators will be integrated into a 3 m deployable membrane mirror structure and delivered to NASA Labs for evaluation.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
TRS Ceramics, Inc.	Supporting Organization	Industry	State College, Pennsylvania

Primary U.S. Work Locations	
California	Pennsylvania

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems